Electronic Supplementary Material (ESI) for RSC Advances.

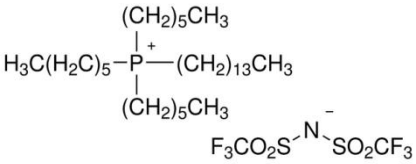
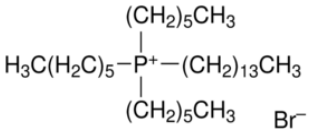
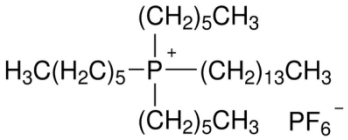
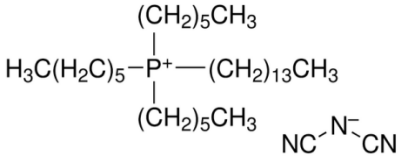
Supporting Information

Room temperature ionic liquid assisted synthesis of ultra-stable Au nanoparticles via a modified Brust-Schiffrin method

Limin Wu, Jingfang Zhou* and Haolan Xu*

RTIL	**Miscible with toluene**	**Extraction of $AuCl_4^-$**	Other
$P_{14,6,6,6}NTf_2$	√	√	
$P_{14,6,6,6}Cl$	√	-	Turbid mixture
$P_{14,6,6,6}Br$	√	√	
$P_{14,6,6,6}NH(CN)_2$	√	√	
$P_{14,6,6,6}PF_6$	√	√	
$P_{8,8,8,8}Br$	√	√	
$P_{14,4,4,4}Cl$	√	-	Turbid mixture
$P_{4,4,4,4}Cl$	√	×	
$N_{8,8,8,1}NTf_2$	√	√	
$N_{4,1,1,1}NTf_2$	×	×	
EMIM NTf_2	×	-	
HMIM NTf_2	×	-	
HMIM PF_6	×	-	
MPPiper NTF_2	×	-	
MPPyrro NTf_2	×	-	
PPri NTf_2	×	-	

Table S1. List of the sixteen RTILs and the corresponding physical and chemical properties.
√: positive; ×: negative; -: data not available

Name	Abbreviation	Structure
Trihexyltetradecylphosphonium bis (trifluoromethylsulfonyl) imide	$P_{14,6,6,6}NTf_2$	
Trihexyltetradecylphosphonium bromide	$P_{14,6,6,6}Br$	
Trihexyltetradecylphosphonium hexafluorophosphate	$P_{14,6,6,6}PF_6$	
Trihexyltetradecylphosphonium dicyanamide	$P_{14,6,6,6}NH(CN)_2$	

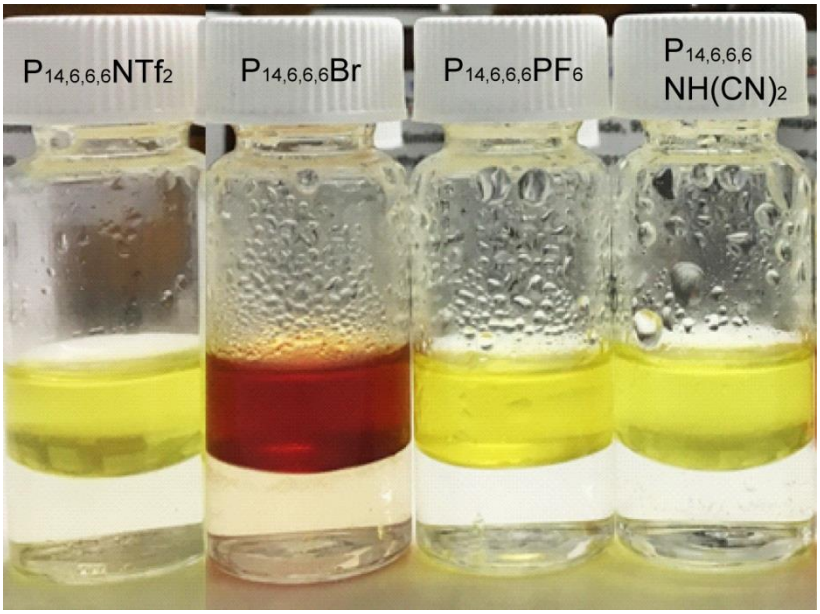


Fig. S1 List of the selected RTILs and the digital photographs of water-RTILs after Au ion extraction, the upper layers are RTILs containing extracted Au ion.

Ionic Liquid	$Au@P_{14,6,6,6}NTf_2$	$Au@P_{14,6,6,6}Br$	$Au@P_{14,6,6,6}PF_6$	$Au@P_{14,6,6,6}NH(CN)_2$
Average Zeta Size(d. nm)	6.5±1.8	6.0±1.2	7.0±1.8	10.1±2.2

Fig. S2 Digital photographs and DLS size of the $Au@P_{14,6,6,6}NTf_2$, $Au@P_{14,6,6,6}Br$, $Au@P_{14,6,6,6}PF_6$, and $Au@P_{14,6,6,6}NH(CN)_2$ NPs (from left to right).

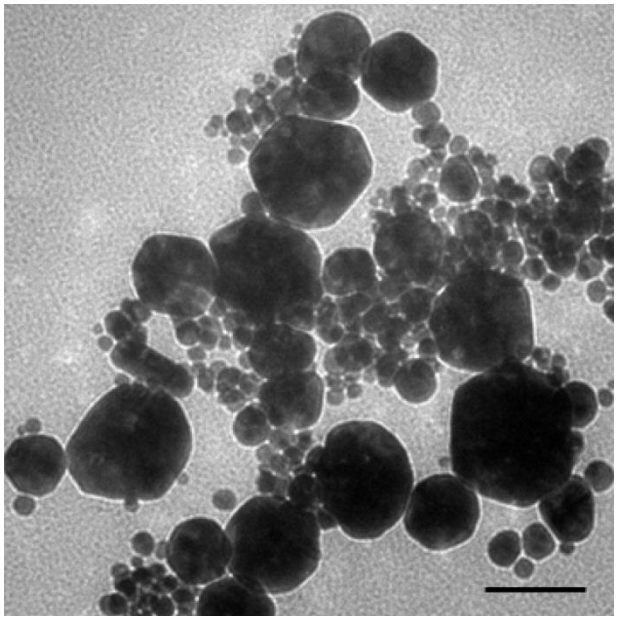


Fig. S3 TEM image of Au NPs prepared with TOAB via BS method, the scale bar is 50 nm.

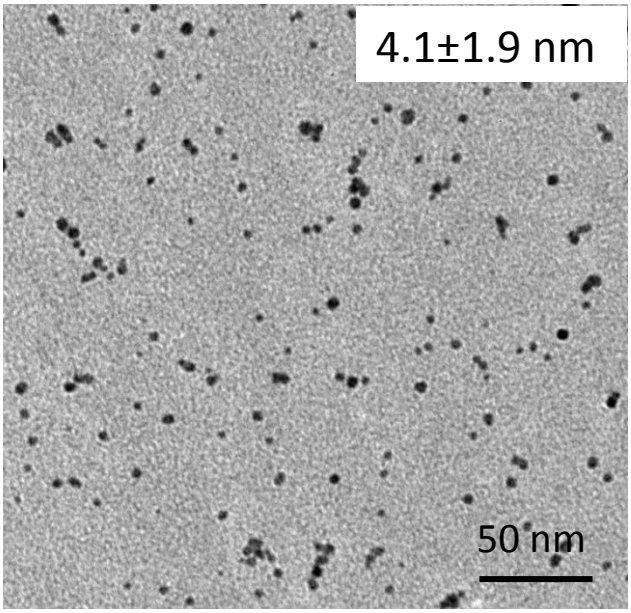


Fig. S4 TEM image of the Au@$P_{14,6,6,6}NTf_2$ NPs synthesized when R is 16.

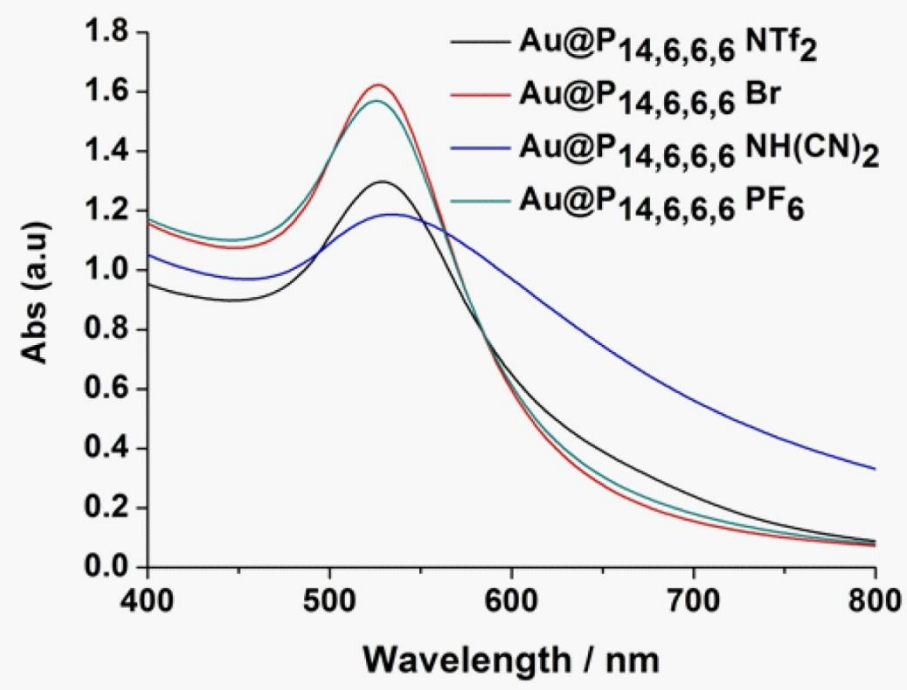


Fig. S5 UV-vis spectra of the Au@$P_{14,6,6,6}NTf_2$, Au@$P_{14,6,6,6}Br$, Au@$P_{14,6,6,6}PF_6$, and Au@$P_{14,6,6,6}NH(CN)_2$ NPs.

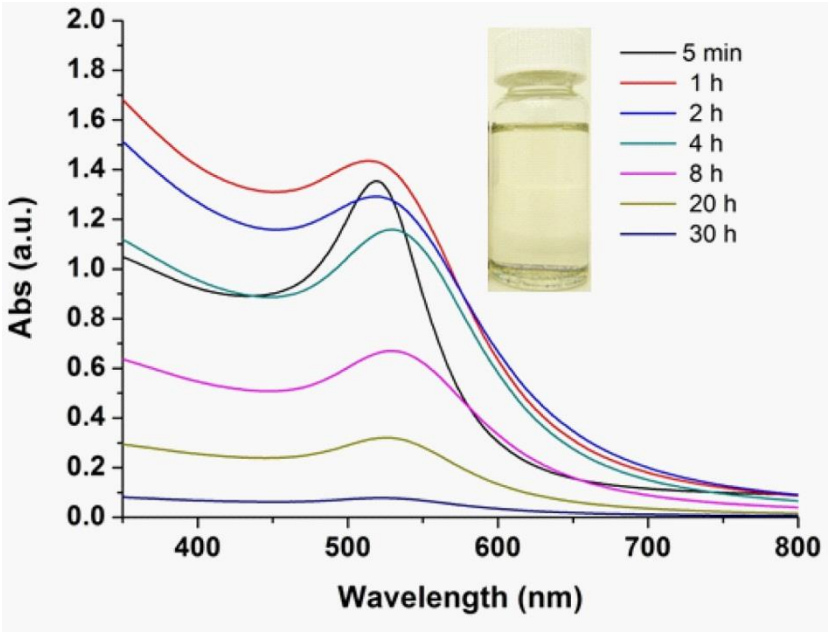


Fig. S6 UV-Vis spectra of Au@TOAB NPs along with storage period. The particles precipitated out after 30 h.

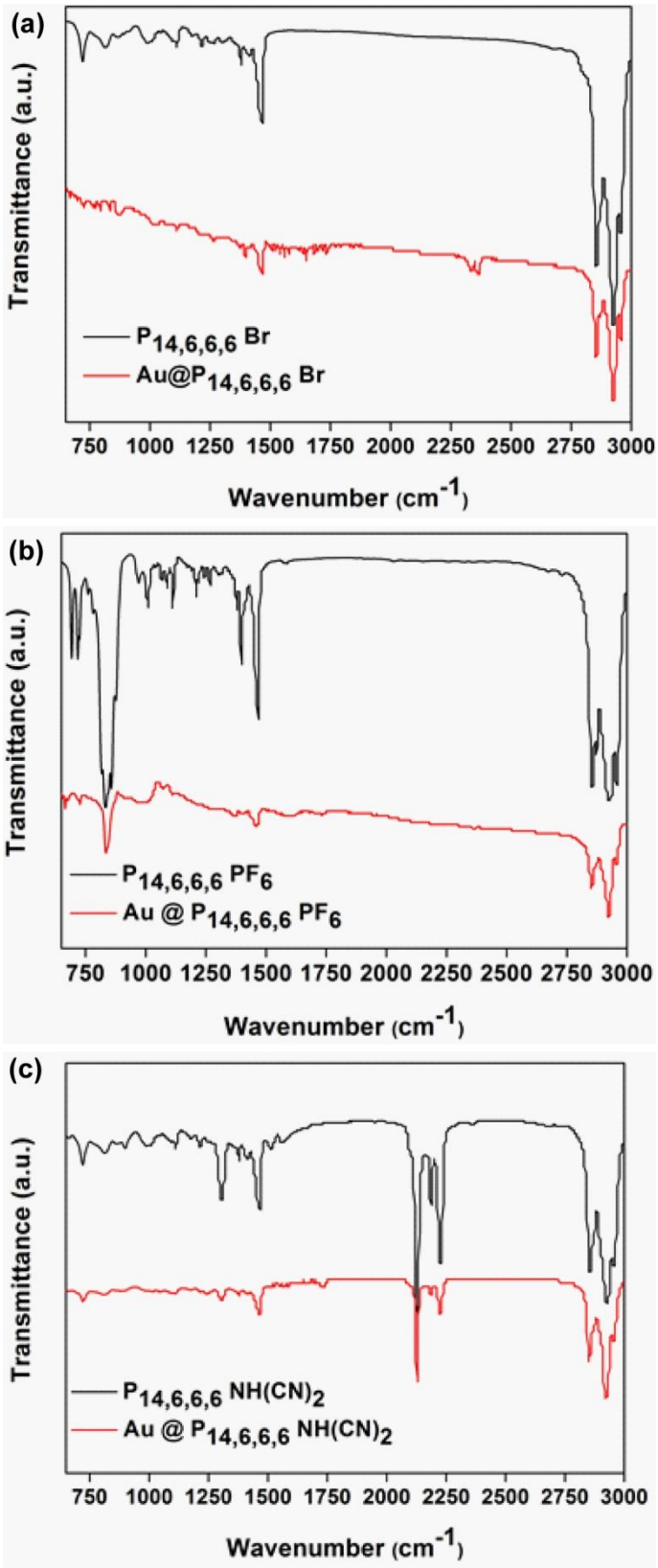
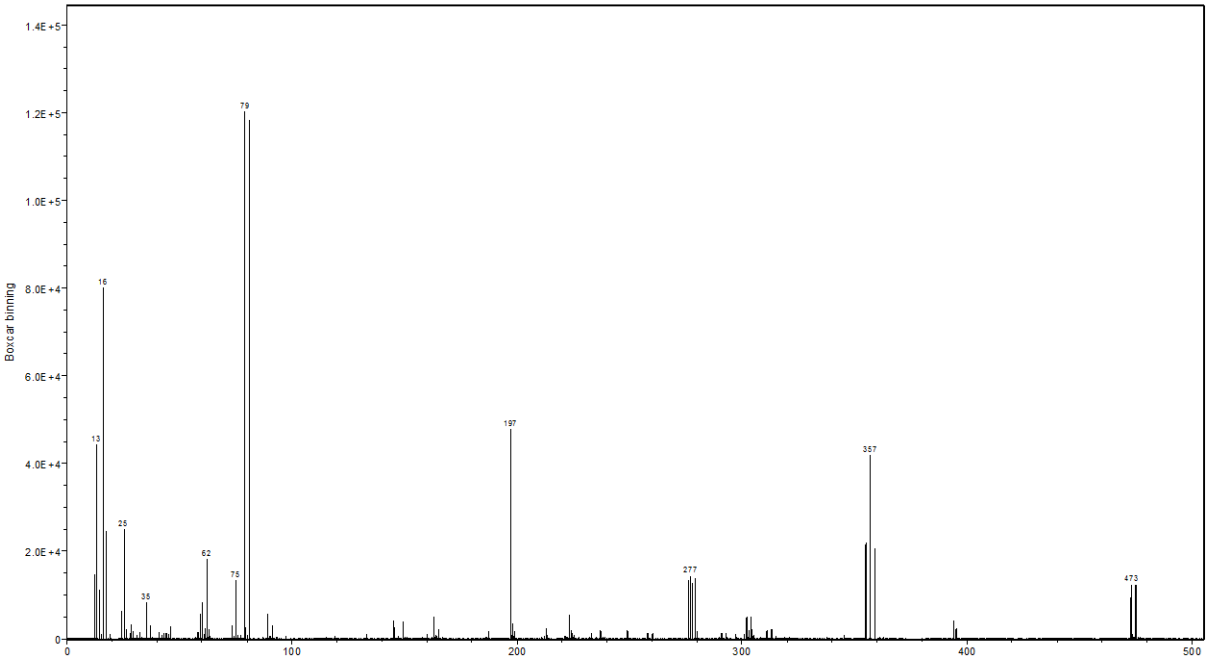
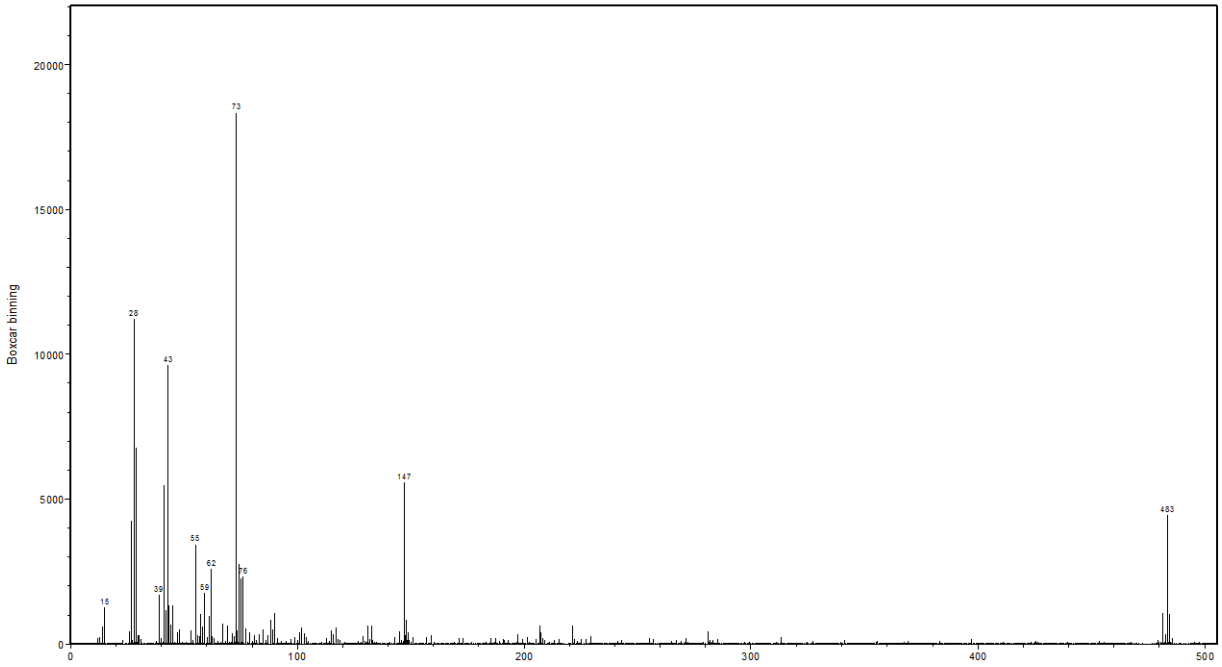


Fig. S7 FTIR spectra of (a) Au@$P_{14,6,6,6}$Br NPs and pure $P_{14,6,6,6}$Br, (b) Au@$P_{14,6,6,6}PF_6$ and pure $P_{14,6,6,6}PF_6$ and (c) Au@$P_{14,6,6,6}NH(CN)_2$ NPs and pure $P_{14,6,6,6}NH(CN)_2$.



m/z	13	16	19	35,37	145	232,277	197	397~485
Main Ions	CH^-	O^-	F^-	$^{35}Cl^-$,$^{37}Cl^-$	PF_6^-	Au^+Cl^-, $AuCl_2^-$	Au^-	$C_nH_{2n+2}P$ (M^+)

Fig. S8 ToF-SIMS spectrum and identification of the characteristic peaks of $Au@P_{14,6,6,6}PF_6$ NPs.



m/z	13	16	25	46	79, 81	197	276~279	302, 304	338, 340	397~485
Main Ions	CH$^-$	O$^-$	C_2H^-	CH_3P^-	$^{79}Br^-$, $^{81}Br^-$	Au$^-$	$AuBr^-$, $AuBrH^-$, $AuBrH_2^-$, $AuBrH_3^-$	$C_2H_2AuBr^-$, $C_2H_4AuBr^-$	$C_5H_2AuBr^-$, $C_5H_4AuBr^-$	$C_nH_{2n+2}P$ (M^+)

Fig. S9 ToF-SIMS spectrum and identification of the characteristic peaks of $Au@P_{14,6,6,6}Br$ NPs.